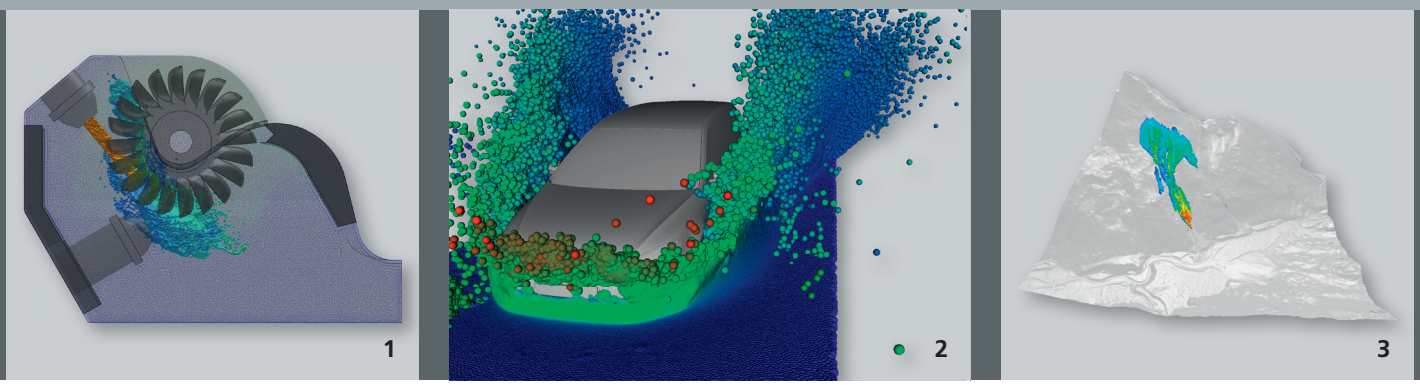
Fraunhofer



MESHFREE

SIMULATIONS WITH MESHFREE

1 *Water-air interaction in a Pelton turbine*

2 *Water crossing of a car*

3 *Simulation of an avalanche*

Computer simulations are an indispensable tool in product design. In common workflows, the preprocessing step consisting of mesh generation and adaptation is very time consuming and leads to increasing costs. With MESHFREE, we provide a solution to overcome this bottleneck. The tool follows an innovative point cloud approach, avoiding meshes, and thus enables engineers to design their products much faster. MESHREE is a powerful simulation tool for fluid dynamics, continuum mechanics, and multiphase scenarios.

Software

A general continuum mechanics approach is the basis for models of a vast variety of non-linear physical phenomena such as non-Newtonian fluids and other complex materials. In contrast to classical mesh-based approaches, MESHFREE uses an automatically managed point cloud that adapts itself efficiently to the simulation domain. The unique features of MESHFREE enable numerical simulations of scenarios that are currently out of reach of other tools: simulation domains changing rapidly due to moving parts.

Advantages of MESHFREE:

- MESHFREE is fully MPI parallelized and scales well on clusters (shared and distributed).
- MESHFREE internally uses SAMG – a powerful library for solving the linear systems of equations based on algebraic multigrid technology.
- MESHFREE is already in productive operation for a wide range of applications. A comprehensive scripting language allows for full flexibility in building new applications and fully automated workflows.

MESHFREE is not a static software. It is under continuous development by Fraunhofer's experts to ensure its status as cutting edge software. The team adds new features and keeps the numerical methods up to date with the latest research results.

Fraunhofer Institute for Industrial Mathematics ITWM

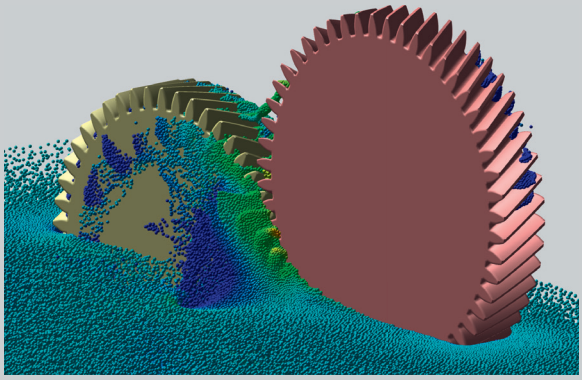
Fraunhofer Institute for Algorithms and Scientific Computing SCAI

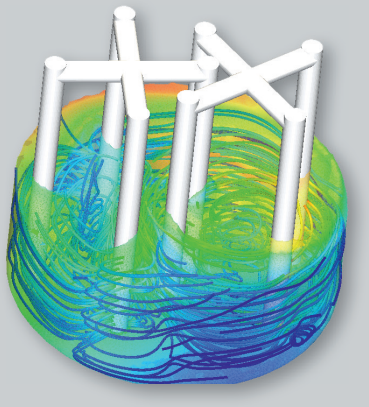
scapos AG (distribution partner)

Contact
MESHFREE Project Team
Phone +49 631 31600-1361
contact@meshfree.eu

www.meshfree.eu

tv_flyer_MESHFREE_EN_neu





1 2 3

1 *Turning gear wheels in an oil bath*

2 *Mixing of dough*

3 *Pointcloud refinement due to error analysis triggered by velocity gradient (Karman vortex street)*

Projects and Partners

MESHFREE is already used in these fields of application:

- Automotive – water management, fuel management, safety, transmission components
- Hydro power – torques, nozzle filling, deflector efficiency, abrasion in Pelton turbines
- Manufacturing engineering – dry and wet metal cutting
- Chemical engineering – static mixing, dynamic mixing and stirring, mold filling
- Natural hazards – runout zones of avalanches, stability analysis of floating bridges
- Food industry – filling, froth formation, baking processes, melting and coating, cleaning
- Medicine and health – flow in flexible structures

In many industries, there is a high demand for virtualization in the early stages of product design. Computer simulations have to reliably enable the detection and elimination of problems as well as the optimization of design aspects long before the first expensive prototype is built. MESHFREE offers a fast and efficient solution towards virtualization of product design. Thus, it has already attracted a number of clients and research partners.

Selected industrial partners are:

- ESI Group
- General Dynamics European Land Systems – Germany GmbH
- IAV GmbH
- Plastic Omnium Auto Inergy Belgium
- Volkswagen Group
- Voith Hydro Holding GmbH & Co. KG

»Fraunhofer has already shown its expertise in water management simulations. For us, MESHFREE is a high-potential software.«

Robert Reilink, Manager Function (Body Engineering CAE), Porsche AG

Services

To ensure the best possible cooperation, Fraunhofer offers accompanying services along the entire product and process development cycle:

- Licensing – our partners can license MESHFREE to simulate any application on their own hardware
- Contract simulations – our partners order MESHFREE simulations for specific applications on Fraunhofer's hardware
- Feasibility studies – novel applications of partners are investigated at Fraunhofer
- Research projects – new features and models are developed within the framework of industrial and publicly funded projects in cooperation with our partners from industry, research institutes, and academia
- Supporting young academics – assisting students in using MESHFREE for their thesis